

**Remarks:**

Applicants appreciatively acknowledge the Examiner's confirmation of receipt of Applicants' claim for priority and certified priority document under 35 U.S.C. § 119(a)-(d).

Reconsideration of the application, as amended herein, is respectfully requested.

Claims 1 - 20 are presently pending in the application.

Claims 1 - 4 and 13 - 19 are subject to examination and claims 5 - 12 and 20 have been withdrawn from examination. Claims 14 - 19 have been amended. Claim 13 has been canceled.

On page 2 of the above-identified Office Action, claim 16 was objected to for an alleged lack of sufficient antecedent basis for "the one hand". Claim 16 has been amended to address the above objection. Support for these changes may be found in Fig. 3B of the instant application and on page 14, line 25 - page 15, line 4 of the specification of the instant application.

On page 3 of the Office Action, claims 1 - 2 were rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U. S. Patent No. 6,323,509 to Kusunoki ("KUSUNOKI") and claims 1 - 4 were rejected under 35 U.S.C. § 102(b) as allegedly being

anticipated by U. S. Patent No. 4,689,647 to Nakagawa et al  
("NAKAGAWA").

On page 5 of the Office Action, claims 13 - 15 and 17 - 19  
were rejected under 35 U.S.C. § 103(a) as allegedly being  
obvious over U. S. Patent No. 4,893,165 to Miller et al  
("MILLER") in view of an article to Hajime et al. ("HAJIME").  
On page 6 of the Office Action, claim 16 was rejected under  
35 U.S.C. § 103(a) as allegedly being obvious over MILLER and  
further in view of NAKAGAWA.

Applicants respectfully traverse the above rejections, as  
applied to the amended claims.

Before discussing the prior art in detail, it is believed that  
a brief review of the invention as claimed, would be helpful.  
Applicants' amended claim 1 recites, among other limitations:

"at least one emitter short region of a second  
conductivity type **integrated substantially only in a  
region of said high-voltage edge**, said at least one  
emitter short region lying in a plane with said at  
least one emitter region and forming an electrode of  
the antiparallel diode;

**said at least one emitter region having no emitter  
short regions within said high-voltage edge;**

**said emitter region having a thickness of less than 1  
micrometer and a doping with a dose of between  $1 \cdot 10^{12}$   
and  $1 \cdot 10^{15}$  charge carriers per  $\text{cm}^2$ ; and**

said semiconductor wells on said front side of said semiconductor substrate forming a counterelectrode of the antiparallel diode." [emphasis added by Applicants]

As such, all of Applicants' amended claims require, among other limitations, an IGBT including: 1) emitter short regions integrated substantially only in the area of the high voltage edge, so that the emitter regions within the high voltage edge do not show emitter shorts, and that the counterelectrode of the antiparallel diode is formed by semiconductor wells on the front side of the chip (see, the instant application, page 6, lines 18 - page 7, line 1); and 2) said emitter region having a thickness of less than 1 micrometer and a doping with a dose of between  $1 \cdot 10^{12}$  and  $1 \cdot 10^{15}$  charge carriers per  $\text{cm}^2$  (see, the instant application, page 8, lines 4 - 8).

The specification of the instant application supports an embodiment including both elements 1) and 2), above. See, the instant application, page 20, line 17 - page 21, line 4, and more particularly, page 21, lines 2 - 4, which states:

"For the rest, the IGBT according to this second aspect may be constructed in the same way as the above-described IGBTs of Figs. 3A, 3B and 4A to 4E."

As will be shown herebelow, the references cited in the Office Action neither teaches, nor suggests, the combination of elements of Applicants' amended claim 1.

More particularly, the KUSUNOKI reference was cited on page 3 of the Office Action against original claim 1. In the Office Action, it was alleged that KUSUNOKI disclosed:

" . . . at least one emitter region 4 of the first conductivity type formed at said rear side of said semiconductor substrate; at least one emitter short region 6 of a second conductivity type integrated substantially only in a region of said high voltage edge, said at least one emitter short region lying in a plane with said at least one emitter region and forming an electrode of the antiparallel diode; said at least one emitter region having no emitter short regions within said high voltage edge; . . ."  
[emphasis added by Applicants]

As noted above, Applicants' amended claims require, among other limitations, an emitter region having a thickness of less than 1 micrometer and a doping with a dose of between  $1 \cdot 10^{12}$  and  $1 \cdot 10^{15}$  charge carriers per  $\text{cm}^2$ .

However, the KUSUNOKI reference fails to teach or suggest, among other limitations of Applicants' amended claim 1, an emitter region having a thickness of less than 1 micrometer and a doping with a dose of between  $1 \cdot 10^{12}$  and  $1 \cdot 10^{15}$  charge carriers per  $\text{cm}^2$ .

As such, Applicants' claims are believed to be patentable over the **KUSUNOKI** reference.

Similarly, the **NAKAGAWA** reference additionally fails to teach or suggest, among other limitations of Applicants' amended claim 1, an emitter region having a thickness of less than 1 micrometer and a doping with a dose of between  $1 \cdot 10^{12}$  and  $1 \cdot 10^{15}$  charge carriers per  $\text{cm}^2$ . More particularly, in the Office Action, it is stated that **NAKAGAWA** discloses:

" . . . at least emitter region 11 of the first conductivity type formed at said rear side of said semiconductor substrate; at least one emitter short region 21 of a second conductivity type integrated substantially only in a region of said high voltage edge; . . . " [emphasis added by Applicants]

In fact, **NAKAGAWA** specifically teaches away from Applicants' particularly recited limitation of, among other limitations of Applicants' amended claim 1, wherein the emitter region has a thickness of less than 1 micrometer thick. Col. 5 of **NAKAGAWA**, lines 16 - 19 specifically teach:

"The p+ -type layer 11 is formed in the surface area of the n+ -type layer 10 at the location where the layer 11 faces the n+ -type regions 14-1 to 14-4 so as to have a thickness of 5 to 8  $\mu\text{m}$ ." [emphasis added by Applicants]

As such, **NAKAGAWA** fails to teach or suggest Applicants' invention of amended claim 1, and in fact teaches away from Applicants' amended claims. Further, if the teachings of the

**NAKAGAWA** reference were modified to cover Applicants' claimed invention, the teachings of the **NAKAGAWA** reference to form the emitter region between 5 to 8  $\mu\text{m}$  would, resultantly, be destroyed. As such, no combination of the references with **NAKAGAWA** can even be made, without destroying the teachings of the **NAKAGAWA** reference, that would teach or suggest Applicants' claimed invention.

As such, Applicants' claims are believed to be patentable over the **NAKAGAWA** reference.

Additionally, the **MILLER** and **HAJIME** references fail to teach or suggest the combination of elements present in Applicants' amended claim 1.

As noted on page 5 of the Office Action, the **MILLER** reference fails to teach or suggest emitter short regions. As such the **MILLER** reference cannot teach or suggest Applicants' invention of amended claim 1. **MILLER** doesn't teach or suggest Applicants' claimed emitter short regions, and as such, cannot teach or suggest, among other limitations of Applicants' claims:

"at least one emitter short region of a second conductivity type integrated substantially only in a region of said high-voltage edge, said at least one emitter short region lying in a plane with said at

least one emitter region and forming an electrode of the antiparallel diode;

said at least one emitter region having no emitter short regions within said high-voltage edge;"  
[emphasis added by Applicants]

In the Office Action, **MILLER** is combined with the **HAJIME** reference to allegedly teach certain limitations of Applicants' claims. However, neither **Miller**, nor **HAJIME**, teach or suggest the above limitations of Applicants' claims.

In fact, the **HAJIME** reference specifically teaches away from Applicants' particularly claimed IGBT including, among other limitations, at least one emitter short region of a second conductivity type integrated substantially only in a region of said high-voltage edge, **said at least one emitter region having no emitter short regions within said high-voltage edge.**

More particularly, in **HAJIME** the emitter shorts are arranged alternately with emitter regions (see Fig. 1a of **HAJIME**), and as such, the emitter shorts of **HAJIME** are also integrated into the emitter region. As such, the combination of **MILLER** with **HAJIME** neither teaches, nor suggests Applicants' invention of amended claim 1.

Further, none of the cited references can be combined with **HAJIME** to allegedly teach Applicants' claimed invention. Were **HAJIME** to be combined with any other reference, in an attempt

to cover Applicants' amended claim 1, the combination would utterly destroy the teachings of the **HAJIME** reference, wherein the emitter shorts are integrated into the emitter regions. Thus no such combination of references can be permissibly made.

Because the teachings of the cited references either don't teach or suggest Applicants' claims, or otherwise would be destroyed by combination with each other, as detailed above, it is believed that no combination of the references teaches or suggests Applicants' invention of amended claim 1. It is accordingly believed that none of the references, whether taken alone or in any combination, teach or suggest the features of Applicants' amended claim 1. Claim 1 is, therefore, believed to be patentable over the art. The dependent claims are believed to be patentable as well because they all are ultimately dependent on claim 1.

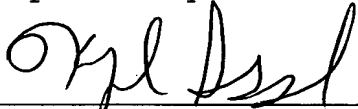
In view of the foregoing, reconsideration and allowance of claims 1 - 4 and 14 - 19 are solicited.

In the event the Examiner should still find any of the claims to be unpatentable, counsel would appreciate receiving a telephone call so that, if possible, patentable language can be worked out.

If an extension of time for this paper is required, petition  
for extension is herewith made.

Please charge any fees that might be due with respect to  
Sections 1.16 and 1.17 to the Deposit Account of Lerner and  
Greenberg, P.A., No. 12-1099.

Respectfully submitted,



For Applicants

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